

among the rocks on the sea-shore ; but whether the place of their capture was above or below high-water mark, is not stated on the ticket with which the specimens are labelled.

Dr. Grube's specimens were taken at St. Malo.
December 17.

R. I. Pocock.

SUGGESTIONS FOR THE FORMATION AND ARRANGEMENT OF A MUSEUM OF NATURAL HISTORY IN CONNECTION WITH A PUBLIC SCHOOL.

HAVING lately been asked by Dr. Warre, Head Master of Eton, to give him some assistance in the fitting up, arrangement, and management of the museum about to be inaugurated at that College, I put down some notes, which he was pleased to think might be of use in pointing out the lines that should be followed with most advantage. As these notes are equally applicable to other school museums, I venture to publish them for the information of those who may be in position to profit by them, premising that they are mere outlines, which are susceptible of much elaboration in detail, and of some modifications according to special circumstances.

The subjects best adapted for such a museum are zoology, botany, mineralogy, and geology.

Everything in the museum should have some distinct object, coming under one or other of the above subjects, and under one or other of the series defined below, *and everything else should be rigorously excluded.* The curator's business will be quite as much to keep useless specimens out of the museum, as to acquire those that are useful.

The two series or categories under which the admissible specimens should come are the following :—(1) Specimens illustrating the teaching of the natural history subjects adopted in the school, arranged in the order in which the subjects are, or ought to be, taught. (2) Some special sets of specimens of a nature to attract boys to the study of such branches of natural history as readily lie in the path of their ordinary life, especially their school life, and to teach them some of the common objects they see around them.

The specimens of the first class should be all good of their kind, carefully prepared and displayed, and fully labelled. They should also be so arranged that they can be seen and studied without being removed from their position in the case or in any way disturbed or damaged. It would be best that they should never be taken out of the museum, but if it is necessary to remove them for the purpose of demonstration at lectures or classes, special provision should be made by which a whole tray or case can be moved together, with due precautions against disturbing the individual specimens. As a rule, the teachers should either bring the classes into the museum for demonstrations, or they should rely upon a different set of specimens kept in store in the class-rooms, and only brought out when required, and which may be handled and examined without fear of injury. Really good permanent preparations may be looked at, but not touched except by very skilled hands.

In zoology the collection should consist of illustrations of the principal modifications of animal forms, living and extinct, a few selected typical examples of each being given, showing the anatomy and development as well as the external form. The series now in the course of arrangement in the Central Hall of the Natural History branch of the British Museum, in the Cromwell Road, may, as far as it is complete, be taken as a guide, but for a school museum it will not be necessary to enter so fully into detail as in that series.

In botany there should be a general morphological collection, showing the main modifications of the different organs in the greater groups into which the vegetable

kingdom is divided, and illustrating the terms used in describing these modifications. Such a collection may also be seen (although still far from complete) in the same institution.

For a teaching collection of minerals, an admirable model has for several years past been exhibited in the Mineralogical Gallery of the Natural History Museum, being, in fact, the various paragraphs of Mr. Fletcher's "Introduction to the Study of Minerals" cut up, and with the statements in each illustrated by a choice specimen.

The geological collection would best be limited mainly to a series illustrating the rocks and characteristic fossils of the British Isles, arranged stratigraphically. There would be no difficulty in making such a series on any scale, according to the space available, and if well selected and arranged, it would be extremely instructive and form a complete epitome of the whole subject. It should be placed in a continuous series along one side of the room, beginning with the oldest and ending with the most recent formations. It might be preceded by some general specimens illustrating the various kinds of rock structures, &c.

Mineral and fossil specimens are generally to be procured as wanted from the dealers, and as they require little or no preparation, collections illustrating these subjects can be quickly made, if money is available for the purpose. This is not, however, the case with zoological and botanical specimens, most of which require labour, skill, and knowledge to be expended upon their preparation before they can be preserved in such a manner as to make them available for permanent instruction.

We will next proceed to consider what objects may be included under the second head, many of which need not be constantly exhibited, but may be preserved in drawers for special study. These may be—

(1) A well-named collection of the commoner British insects, especially those of the neighbourhood in which the school is situated, with their larvæ, which should (if means will allow) be mounted on models of the plants upon which they feed. All should have their localities and the date of capture carefully recorded. These are best kept in a cabinet, with glass-topped drawers, with a stop behind, so as to allow them to be pulled out for inspection, but not entirely removed. Such a collection, formed of specimens prepared and presented by Lord Walsingham, can now be seen in the British Room of the Natural History Museum.

(2) A similar collection of British shells, especially the land and freshwater shells of the neighbourhood.

(3) If space and means allow, a collection of British birds, especially the best-known and more interesting species. Rare and occasional visitors, reckoned in the books as British, which are the most expensive and difficult to procure, are the least important for such a collection. Variations in plumage in young and old, and at different seasons, should be shown in some common species. Every specimen must be good and well mounted, or it is not worth placing in the museum.

(4) The principal British mammals of smaller size, especially the bats, shrews, and mice.

(5) The British reptiles, Amphibia, and commoner fishes, so shown that their distinctive characters may be recognized.

(6) A collection, as complete as may be, of British plants, or at all events of the plants of the neighbourhood. By far the best way of preserving and exhibiting such a collection is in glazed frames, movably hinged upon an upright stand, as may be seen in the Botanical Gallery of the Natural History Museum. A collection arranged in this manner should find a place in every local museum of natural history.

(7) A collection of the fossils found in the quarries of the neighbourhood, should there be any.

Every collection or series should be kept perfectly dis-

tinct from and independent of the others, and its nature and object clearly indicated by a conspicuous label.

The exhibited specimens should be arranged in upright wall-cases or in table-cases on the floor of the room. For the latter a high slope is preferable, and in all the exhibition space should not extend too high or too low for comfortable inspection. Between three to six or seven feet from the floor should be the limits for the exhibition of small objects. The three feet nearest the floor may be inclosed with wooden doors forming cupboards or fitted with drawers. Glass in this situation is liable to be broken by the feet or knees.

The museum should have a permanent curator—a man of general scientific attainments, and who is specially acquainted with, and devoted to, museum work, and who might also be one of the teachers, if too much of his time is not so occupied. But, as he is not likely to have special knowledge of more than one branch of natural history, the teachers of the other branches represented in the museum would probably each give advice and assistance with regard to his own department. It is also probable that some of the boys may be sufficiently interested in the work to render valuable aid in collecting and preparing specimens.

If ethnographical, archaeological, historical, or art collections be also part of the general museum scheme, they should be kept quite distinct from the natural history collections, preferably in another room.

Above all things, let the following words of Agassiz be remembered: "The value of a museum does not consist so much in the number as in the order and arrangement of the specimens contained in it."

W. H. FLOWER.

THE FISHERY INDUSTRIES OF THE UNITED STATES.

THE volumes which form the subject of the present article are the continuation of a complete monograph of the fisheries and fishing industries of the United States, of which the first and second sections have already been published under the titles of "A Natural History of Useful Aquatic Animals," and "A Geographical Review of the Fisheries of the United States."

The direction of the immense investigation necessary for the preparation of this work has been in the hands of Mr. G. Brown Goode, who, as early as 1877, had drawn up a scheme for an exhaustive exploration of the coast of the United States in connection with the fishing industry. The enterprise was undertaken jointly by the United States Fish Commission and the Census Bureau, and the expenses of investigation, compilation, office and field work, and publication, have been shared by these two departments.

A work of this magnitude was quite beyond the powers of an individual, and we find accordingly that a number of authors, whose names are given at the back of the title-page, have been associated with Mr. Brown Goode in his undertaking. Among them are many names well known to science from their contributions to the natural history of the United States. Chief among these are Messrs. Marshall MacDonald, J. A. Ryder, and other members of the United States Fish Commission.

An English reader will invariably use his knowledge of British fisheries as a standard for comparison with those of a foreign country, and, in doing so, will find many difficulties, owing, not only to the difference in the species of fish which are found on the two sides of the Atlantic,

but to the fact that many of our common names, such as pollack and hake, are applied to different fish in America, and that the Americans often use an altogether peculiar zoological nomenclature, which may throw even an experienced zoologist into confusion. Many American fishes of great commercial importance are unknown in Great Britain, such as the tautog (*Tautoga onitis*), the squeteague (*Cynoscion regale*), the blue-fish (*Pomatomus saltator*), the menhaden (*Brevoortia tyrannus*), and the shad (*Clupea sapidissima*). The most favourite edible crab of North America (*Callinectes hastatus*), the blue crab, is a perfectly distinct species from our common *Cancer pagurus*. and the American lobster (*Homarus americanus*) and oyster (*Ostrea virginica*) are different from our own. The European sole is unknown in American waters, as are our turbot and brill; the halibut, which has only recently become important in British fisheries, is of great importance in America, and their "plaice" (*Paralichthys dentatus*) differs entirely from the fish known to us by that name. These and many other differences in the species of marketable fish are important, as they serve in part to explain the different methods pursued by American fishermen; why, for instance, beam-trawling is unknown in their waters.

Of the third section of the monograph, which forms a half of the first of the four volumes under consideration, Mr. Brown Goode himself says:—"It is the first report of the kind ever written. It describes the locations, the characteristics, and the productiveness of the numerous grounds resorted to by the fishermen of the United States, extending from Greenland to Mexico, from Lower California to Alaska, and including the fishing grounds of the great lakes." For the Atlantic seaboard this work is carried out on a scale of completeness never before attempted. Not only does the text abound with information relative to the different fishing grounds and banks, their history, productiveness, the character of their bottom, and the weather prevailing there at different seasons, but the whole of this is graphically represented in a series of admirable charts which form in themselves a complete fisherman's guide to the whole coast from Greenland to Mexico. In addition to this, the migrations of different species of fish from locality to locality are alluded to, and the characters of the invertebrate fauna are, in some instances, adduced in explanation of these migrations. It is impossible to criticize this part of the work: to do so one must have a thorough knowledge of all the principal fishing-grounds of America; but, granted that the information and observations on which the charts and text are founded are correct, the method of displaying this information is unimpeachable.

Not the least valuable part of Section III. is the appendix containing the temperature observations from 1881 to 1885 inclusive. A word as to the manner of making these observations will not be out of place. The Census Bureau was, of course, unable to undertake this kind of work, and the Fish Commissioners, whose steamers were constantly engaged in expeditions to various localities, found that they could not keep a sufficiently continuous record of the temperatures observed at different points along the coast. Application was accordingly made to the United States Lighthouse Board and Signal Service, and these departments instructed their *employés* to make the required observations as part of their regular duties, and without extra compensation. The editor acknowledges the thoroughness with which these men performed the gratuitous services demanded of them, and the result is a large number of charts of temperature curves for each observing station, and charts showing the isothermal lines connecting the stations in different years.

The Pacific fisheries are dealt with in a much less complete manner, and are referred to as being undeveloped. The Alaskan fisheries are more fully dealt

¹ "The Fisheries and Fishery Industries of the United States." By George Brown Goode, Assistant Secretary of the Smithsonian Institute, and a staff of Associates. Section III. The Fishing-Grounds of North America, with 49 Charts, edited by Richard Rathbun. Section IV. The Fishermen of the United States, by George Brown Goode and Joseph W. Collins. Section V. History and Methods of the Fisheries; in Two Volumes, with an Atlas of 255 Plates. (Washington: Government Printing Office, 1887.)